

## **Supplementary Content**

**Supplementary Table 1:** Summary of the imaging studies in functional movement disorders

**Table 1:** Summary of the imaging studies in functional movement disorders; **DAT:** Dopamine transporter; **SPECT:** Single-photon emission computed tomography; **F-dopa:** Fluorodopa; **PD:** Parkinson's disease; **PET:** Positron emission tomography; **rCBF:** Relative cerebral blood flow; **FT:** Functional tremor; **ET:** Essential tremor; **fMRI:** functional MRI

Study	Study design	Functional disorder	Sample size	Imaging modality	Results
Felicio A.C et al, 2010	Assessment of 5 patients (3 women, 2 men) with clinically established functional parkinsonism with DAT SPECT using the TRODAT1 tracer.	Parkinsonism	5	DAT imaging using SPECT with TRODAT-1 tracer	In 2 out of 5 patients demonstrated striatal pre-synaptic dopaminergic deficit, attributed to an underlying neurodegenerative etiology.
Benaderette S et al, 2006	Assessment of 9 patients (4 women, 5 men) referred for functional parkinsonism. They underwent [ <sup>123</sup> I]-FP-CIT SPECT and electrophysiological assessment of tremor to establish the correct diagnosis.	Parkinsonism	9	[ <sup>123</sup> I]FP-CIT SPECT	[ <sup>123</sup> I]-FP-CIT SPECT confirmed diagnosis in 3 patients, and 5 had a combination of functional and 'organic' parkinsonism. Diagnosis of overlap for one patient was based on clinical

					suspicion alone, but they had a normal SPECT scan.
Gaig C et al, 2006	Distinguish patients with functional parkinsonism with underlying neurodegenerative parkinsonism.	Parkinsonism	9	<sup>123</sup> I-Ioflupane SPECT	In 1 out of 9 patients, there was bilateral reduction in striatal uptake. This indicated nigrostriatal degeneration, therefore indicating PD and psychogenic tremor can co-exist. Further investigation led to diagnosing this individual with a PARKIN mutation.
Lang AE et al, 1995	Retrospective chart review of 7 women and 7 men with clinically established functional parkinsonism, and establish characteristics that	Parkinsonism	14	F-dopa PET	Of the 4 who underwent F-dopa PET, the scan was normal in 3 patients. Only one had an abnormal scan, and the suspicion was that there was overlap

	distinguish them from organic parkinsonism				with organic parkinsonism.
Factor S et al, 1998	Assessment of 2 individuals with functional parkinsonism with [ <sup>123</sup> I]-FP-CIT SPECT	Parkinsonism	2	[ <sup>123</sup> I]-FP-CIT SPECT	Both individuals had normal DAT density for age
O'Sullivan et al, 1999	Establishing diagnosis in 3 individuals with suspected functional parkinsonism	Parkinsonism	3	[ <sup>123</sup> I]-FP-CIT SPECT	[ <sup>123</sup> I]-FP-CIT SPECT uptake reduced in putamen and caudate in all 2 patients, confirming organic parkinsonism
Booij J et al, 2001	To use imaging with [ <sup>123</sup> I]-FP-CIT SPECT to establish diagnosis in 33 inconclusive cases of parkinsonism. Ratios of specific to non-specific binding to putamen and caudate were calculated and compared to healthy controls.	Parkinsonism	33	[ <sup>123</sup> I]-FP-CIT SPECT	Nigrostriatal degeneration was found in 9 patients, and the remaining 24 had normal imaging. [ <sup>123</sup> I]-FP-CIT SPECT was normal in 19 individuals, 4 of whom were clinical diagnosed

					with functional parkinsonism.
Elmali A.D et al, 2017	Case report of a 31-year-old female presenting with suspected FT. Workup for Wilson's was done because of a family history of cirrhosis.	Tremor	1	MRI brain	<p>Cerebellar and brainstem atrophy, accompanied by T2-FLAIR hyperintensity or the thalami and hypointensity of the basal ganglia. On T1, the thalami were hypointense.</p> <p>-Investigations revealed elevated urine copper, low serum ceruloplasmin, and elevated copper content on liver biopsy, suggestive of Wilson's disease.</p>
Kwon DY et al, 2017	Case report of a 20-year-old male with suspected FT and weakness of the hands. Spine	Tremor	1	MRI spine	MRI spine revealed atrophy at the C5-7 level with anterior displacement of

	imaging revealed Hirayama disease.				the dura with neck flexion
Czarnecki K et al, 2011	Studied 5 patients, comprising of FT, ET and healthy controls with SPECT imaging to determine distinct patterns of rCBF.	Tremor	15	SPECT with 99mTc-Ethyl cysteinate dimer radioligand	<p>Deactivation of the default mode network distinguishes individuals with FT.</p> <p>FT: -At rest→increased rCBF in the left inferior frontal gyrus and left insula</p> <p>-With motor task to enhance tremor→increased rCBF in the cerebellum and reduced rCBF in the anterior regions of the default mode network.</p> <p>ET: -At rest→increased rCBF in the</p>

					<p>cerebellar hemispheres and left inferior frontal gyrus.</p> <p>-With motor task→ increased rCBF in the supplementary motor cortex and contralateral motor cortex.</p> <p>Reduced rCBG in the visual cortex and cerebellum.</p>
Umeh C.C et al, 2013	Using DAT-SPECT imaging to investigate 3 cases of suspected functional parkinsonism	Parkinsonsim	3	[ <sup>123</sup> I]-FP-CIT SPECT	2 had idiopathic PD with comorbid FMD and one had normal imaging suggesting FMD only
Espay AJ et al, 2018	To understand the neural correlates of emotional processing. Cross-sectional study using 27 subjects with FT, 16 with ET, and 25 healthy controls (HCs) underwent a finger-	Tremor	68	fMRI	-After controlling for depression scores, the FT group demonstrated increased activation in the right cerebellum compared to ET

	tapping motor task, a basic-emotion task, and an intense-emotion task to probe motor and emotion circuitries.				<p>during the motor task.</p> <p>-FT patients also had increased activation in the paracingulate gyrus and left Heschl's gyrus compared with HC</p> <p>-FT has decreased activation in the right pre-central gyrus compared with ET during the basic-emotion task</p>
Espay AJ et al, 2018	Using fMRI to assess the motor and emotional circuits activated during finger-tapping task (motor task), a basic emotion-recognition task (emotional faces task), and an intense-emotion	Dystonia	49	fMRI	-In the basic emotion task, those with functional dystonia demonstrated reduced activation of the right middle temporal gyrus and bilateral precuneus, as well



	<p>stimuli task. The subjects included 12 participants with functional dystonia, 12 with primary organic dystonia, and 25 healthy controls.</p>				<p>as increased activation in the right inferior frontal gyrus, fusiform gyrus, bilateral occipital cortex and cerebellum.</p> <p>-In the intense-emotion task, they showed reduced activation in the left motor and insular cortices, as well as activation of the left fusiform gyrus. In those with organic dystonia, there was reduced activation of the right opercular cortex and right motor cortex.</p>
Voon V et al, 2010	Using fMRI to distinguish voluntary mimicked	Tremor	8	fMRI	In FT, there is decreased activation of the right temporo-

	tremor with FT in 8 individuals.				<p>parietal junction and in the connectivity between the sensorimotor cortex and cerebellum.</p> <p>This suggests that the sensorimotor feedback integration is impaired in functional disorders and the movement is not self-generated.</p>
Schrag AE et al, 2013	Using PET imaging to study regional blood flow in patient with functional dystonia (n=6), dystonia with DYT1 mutation (n=6) and matched controls (n=6). They were studied at rest, during fixed posturing of the right leg and during	Dystonia	18	PET	<p>-Increased activation of primary motor cortex and thalamus and reduced cerebellar activation in organic dystonia, compared with healthy controls.</p> <p>-In functional dystonia, increased blood</p>

	paced ankle movements.				<p>flow in cerebellum and basal ganglia, and reduced flow to primary motor cortex.</p> <p>-With movement, there was activation of the right dorsolateral prefrontal cortex in both functional and organic dystonia.</p>
Canu E et al, 2016	Using 3D T1 weighted, diffusion tensor (DT) MRI and resting state functional MRI (fMRI) to compare structural and functional differences in individuals with functional dystonia (n=31) and matched healthy controls (n=36)	Dystonia	67	Diffusion tensor and functional MRI	<p>-Compared to matched, healthy controls, those with functional dystonia have a smaller right thalamus and caudate bilaterally, and more atrophied precentral and frontoparietal cortices.</p> <p>-There is also reduced</p>

					functional connectivity between the insula, right basal ganglia, dorsolateral prefrontal cortex and precuneus.
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